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(58) Field of Search

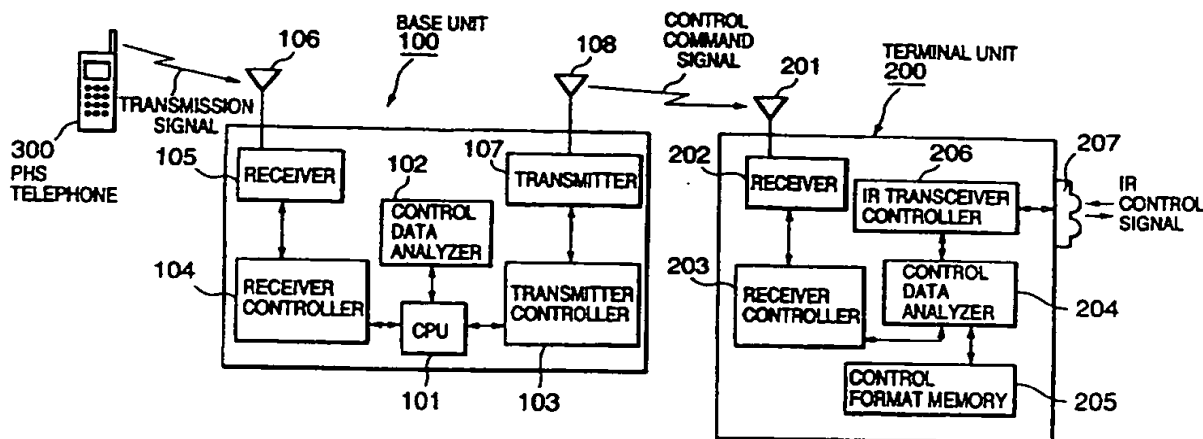
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(54) Abstract Title

Appliance control system eg in home automation

(57) A home automation system is composed of a mobile telephone 300, a base unit 100, a plurality of terminal units 200, and a plurality of electric appliances. The mobile telephone 300 is capable of communicating with the base unit 100 to transmit to the base unit 100 a first control signal conveying appliance identifying data and control data. The base unit 100 includes a transit switch for receiving the first control signal and transmitting a second control signal to a terminal unit 200 determined according to the identifying data included in the first control signal. The terminal unit 200 comprises an appliance controller for controlling a target electric appliance identified by the identifying data included in the second control signal depending on the control data. Communications are by radio, except between terminal units and appliances which uses infrared.

FIG. 1



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FIG. 1

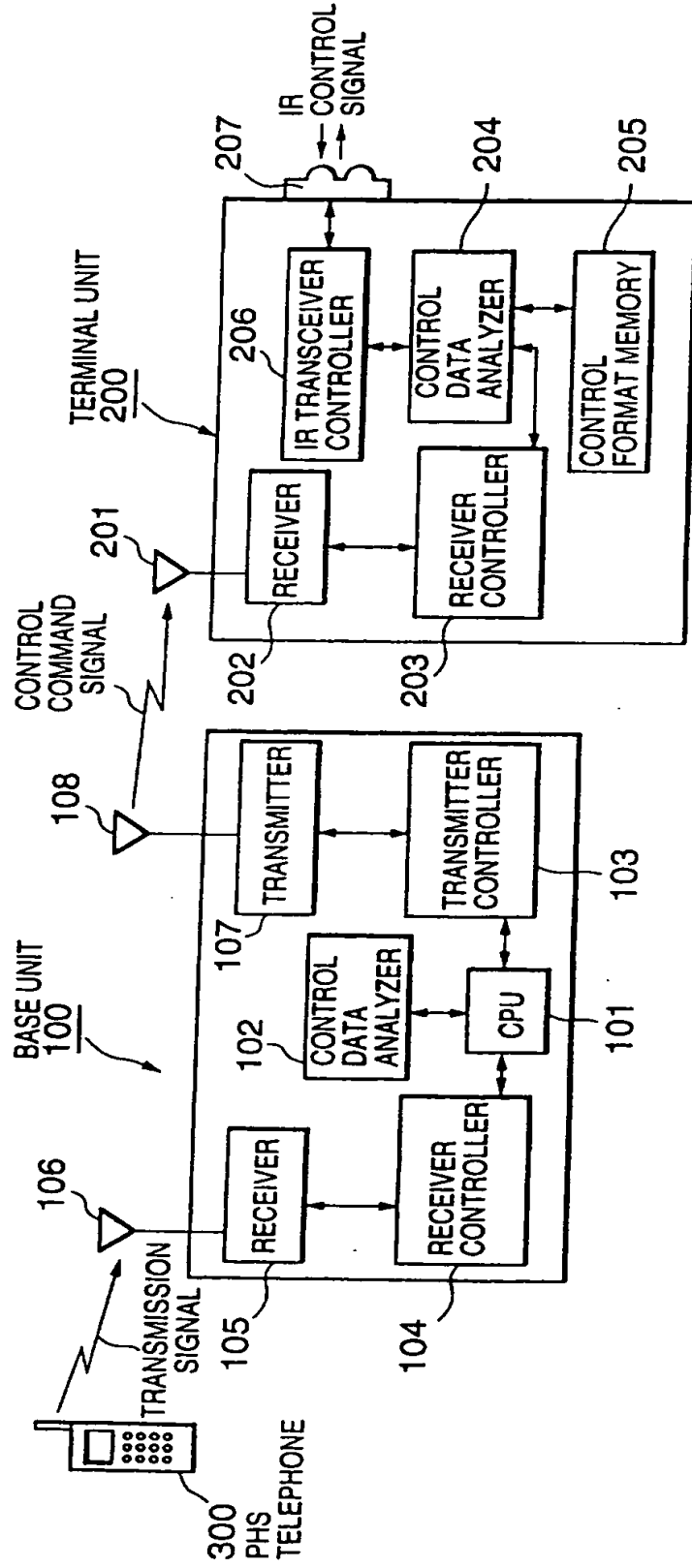


FIG. 2

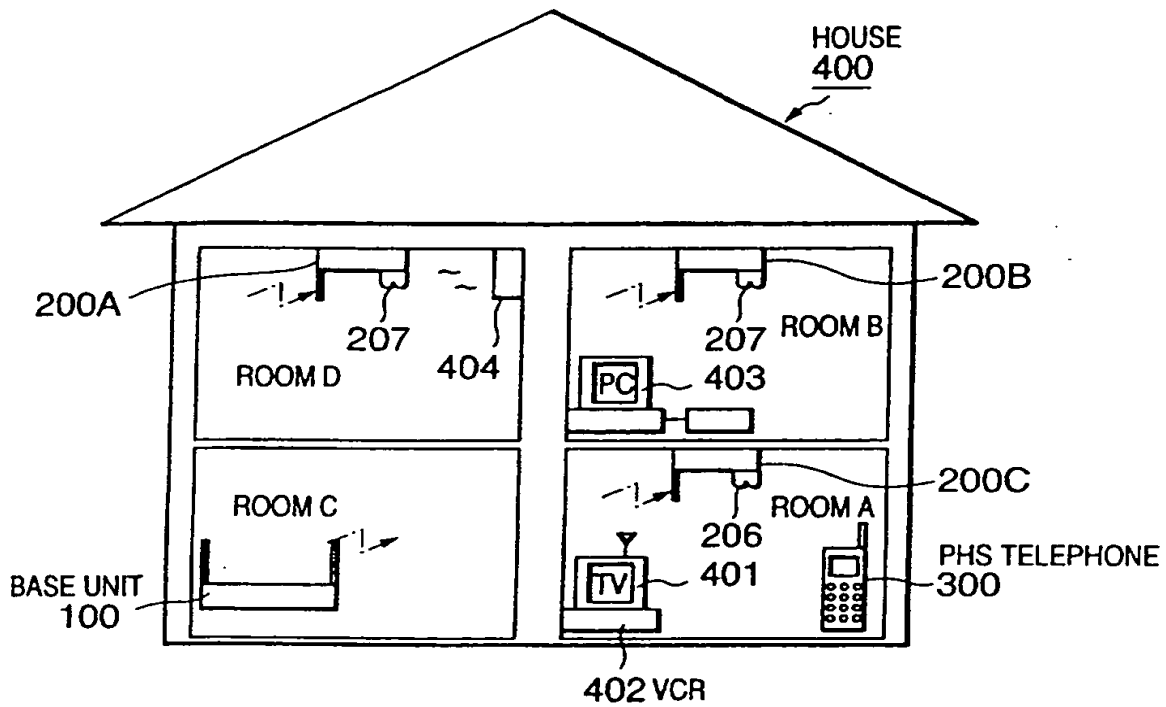


FIG. 3

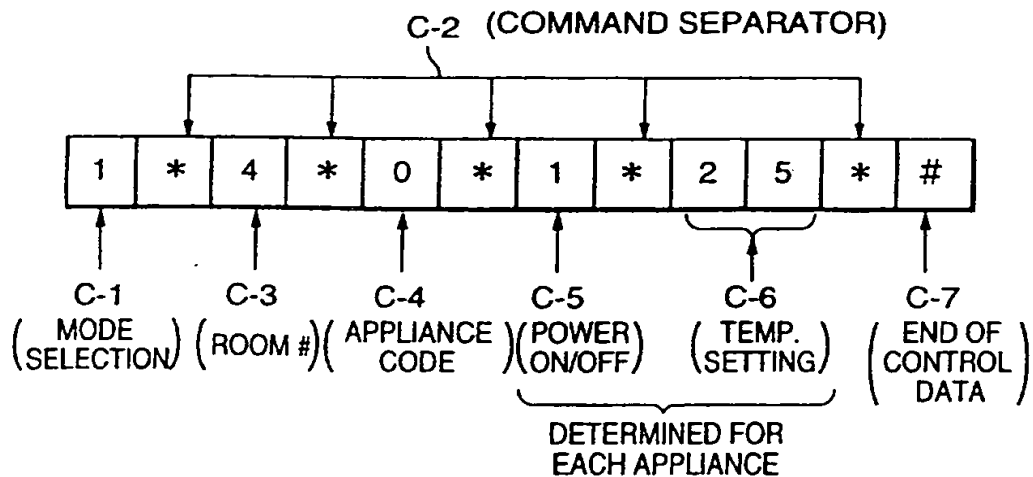
COMMAND FORMAT

FIG. 4

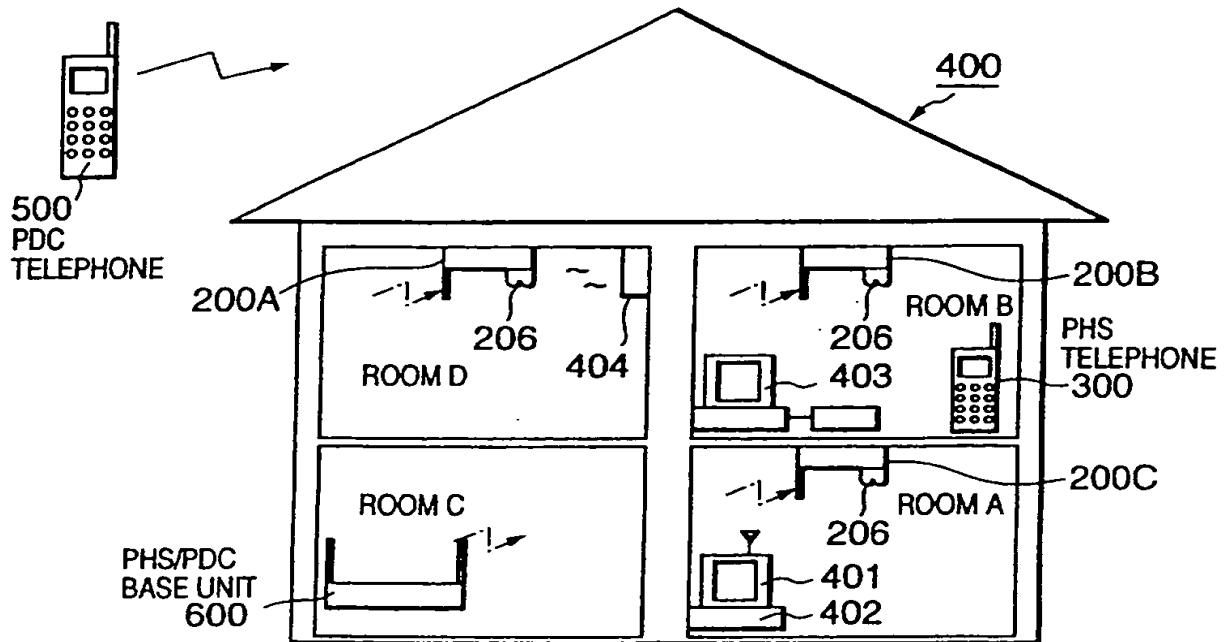


FIG. 5

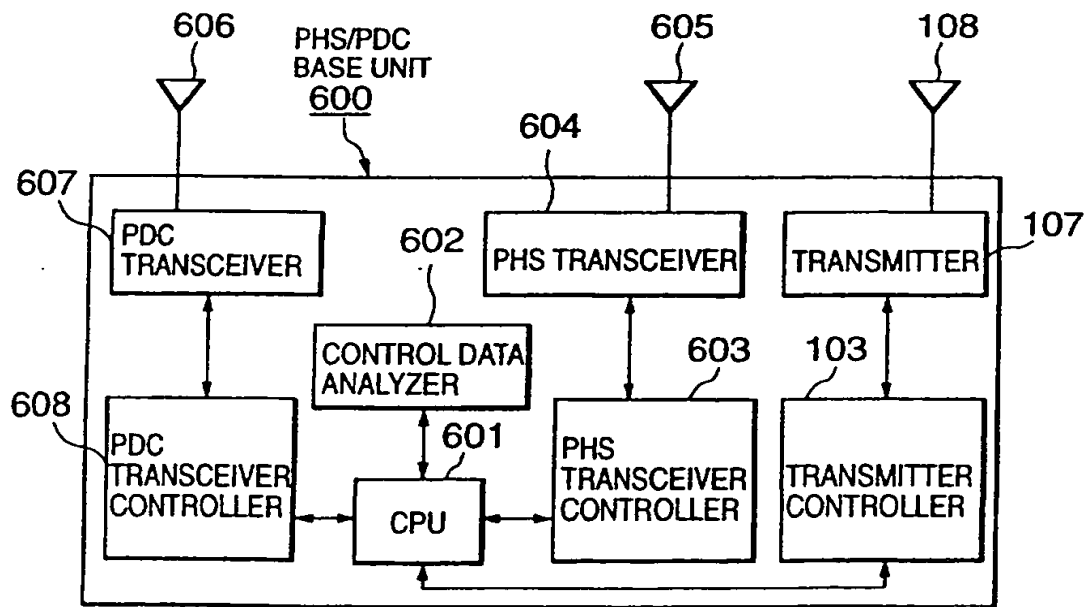


FIG. 6

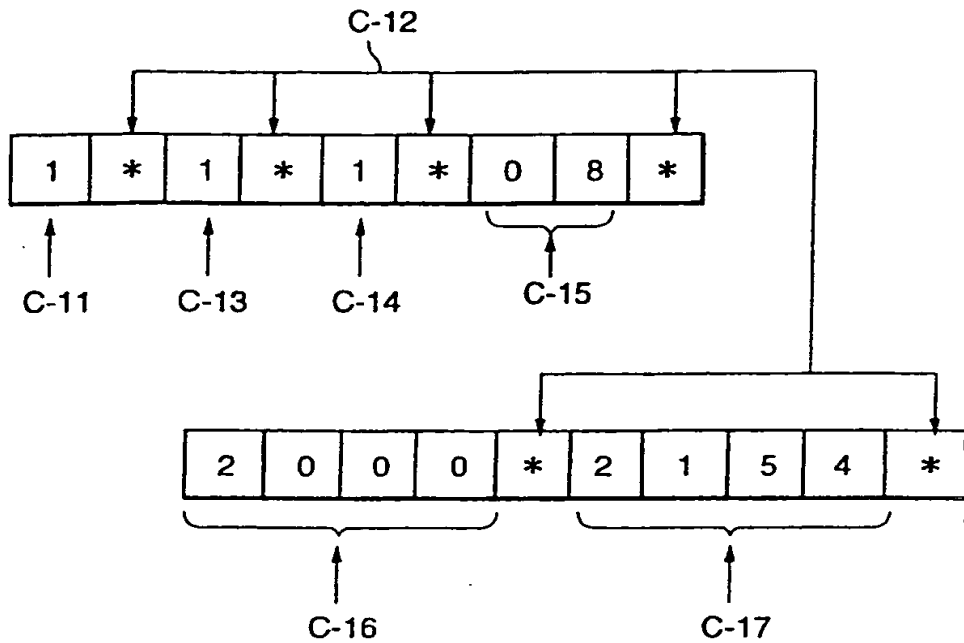


FIG. 7

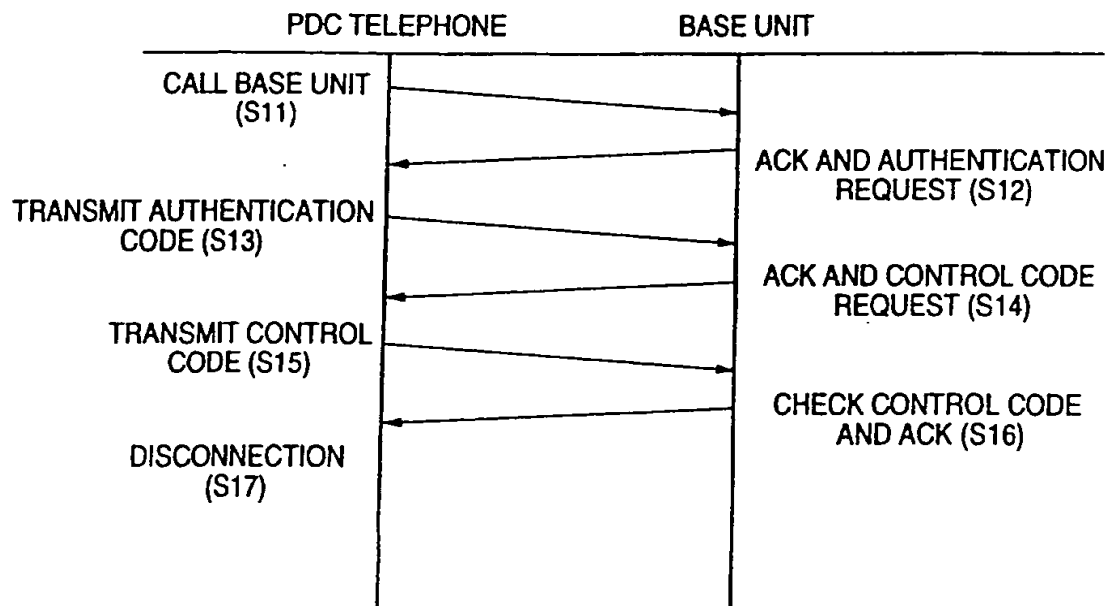
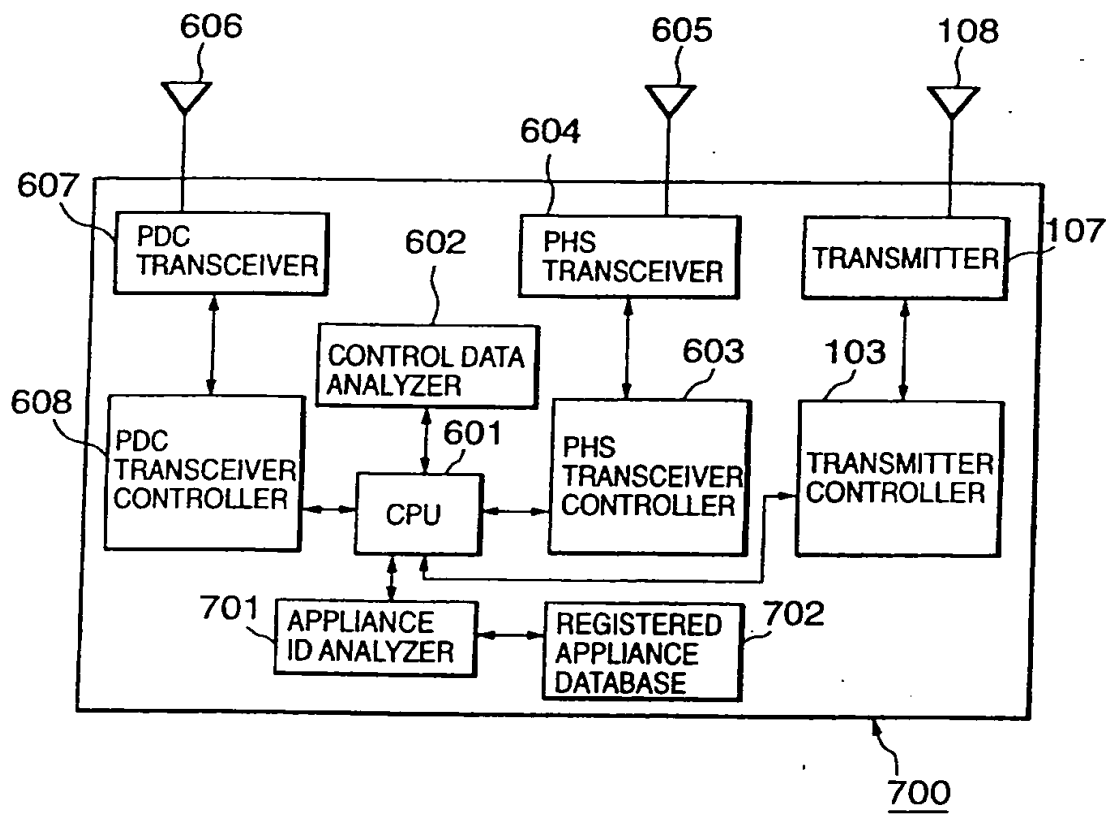


FIG. 8



Control System

BACKGROUND OF THE INVENTION

1. Field of the invention

The present invention generally relates to a control system for electrical appliances, and in particular to a home automation system and method that allow centralized control of a plurality of electrical appliances variously placed or installed in a house.

2. Description of the Related Art

Various kinds of electrical appliances, for example, television set (TV), videocassette recorder (VCR), stereo, and air conditioner, are located and installed in a house. Most of home electrical appliances are provided with wireless remote control units that are used to control the operations thereof including power on/off and various parameters setting/adjusting. In general, a wireless remote control unit uses an infrared (IR) light-emitting diode (LED) to transmit a control signal to the electrical appliance. Since an IR LED can be designed to be very small and light with reduced power consumption and simplified driver circuit, the remote control unit can reduce in size and weight and further can be used for long hours.

Recently, several home automation systems using a cordless telephone have been proposed. A cordless telephone station is

composed of a cordless telephone base unit and a plurality of cordless telephone portable units. Since the cordless telephone portable units are operable at different locations in a limited small area, it is suitable for a home telephone system used in a house having a plurality of rooms. Therefore, a combination of the cordless telephone and the home electrical appliances can provide a convenient home automation system.

There has been proposed a cordless telephone portable unit which has an infrared (IR) remote control function for home electric appliances (Japanese Patent unexamined Publication No. 5-130181). The similar function can be also implemented using the cordless telephone base unit having the IR remote control function (Japanese Patent unexamined Publications Nos. 5-327922 and 10-155030).

Further, there has been proposed a remote control system using a cordless telephone station composed of a cordless telephone base unit and a plurality of cordless telephone portable units each having the IR remote control function for home electric appliances. The home electric appliances can be each controlled by the cordless telephone station from outside through the public telephone network. Therefore, an air conditioner or electric stove can be powered on/off from outside, resulting in enhanced convenience.

However, in the case of a cordless telephone portable unit having the IR remote control function for home electric appliances, the operable area of the remote control is limited to a small area

like a house. In the case of a cordless telephone base unit having the IR remote
5 control function, the operable area of the remote control is limited to the room where
the cordless telephone base unit is installed.

SUMMARY OF THE INVENTION

10 An object of at least the preferred embodiment of the present invention is to
provide a home automation system and method that allow easy control of a plurality
of electric appliances variously located in a house.

Accordingly, the present invention provides a base unit for use in an appliance
control system, comprising:

15 means for receiving a first control signal from a telephone; and
means for transmitting a second control signal to one of a plurality of terminal
units in dependence upon the first control signal to cause said terminal unit to control
an appliance associated with the terminal unit in dependence upon the second control
signal.

20 In another aspect the present invention provides a method of controlling a
plurality of appliances comprising:

transmitting a first control signal from a telephone to a base unit;
transmitting a second control signal from the base unit to one of a plurality of
terminal units in dependence upon the first control signal, thereby causing the
25 terminal unit to control an appliance associated with the terminal unit in dependence
upon the second control signal.

According to another aspect of the present invention, a home automation

10 system comprises a base unit located in a house, a plurality of
terminal units which belong to the base unit and are located in
an area of the house, and a plurality of electric appliances
located in the area of the house. Each of the electric appliances
belongs to one of the terminal units and is capable of being
15 controlled depending on control data. The home automation system
further comprises a mobile telephone capable of communicating with
the base unit, to transmit a first control signal to the base unit,
the first control signal conveying identifying data for
identifying a target electric appliance and control data for the
20 target electric appliance. The base unit comprises a transit
switch for receiving the first control signal from the mobile
telephone and transmitting a second control signal to a terminal
unit determined according to the identifying data included in the

first control signal, the second control signal conveying the identifying data and the control data. The terminal unit comprises an appliance controller for controlling the target electric appliance identified by the identifying data included
5 in the second control signal depending on the control data.

Preferably, the mobile telephone transmits the first control signal of a first radio frequency and the transit switch transmits the second control signal of a second radio frequency different from the first radio frequency. The appliance
10 controller preferably transmits an infrared control signal to the target electric appliance.

The mobile telephone may be one of a PHS (Personal Handy-phone System) telephone and a digital cellular telephone, wherein the identifying data and the control data of the first
15 control signal are input through a ten-key pad provided in the mobile telephone. Preferably, the mobile telephone is one of a PHS telephone and a PDC (Personal Digital Cellular) telephone, and the base unit further comprises a transceiver designed for both the PHS telephone and the PDC telephone.

20 Further preferably, the base unit comprises a database retrievably storing data each identifying the electric appliances; and an identification checker for checking the identifying data included in the first control signal whether the identifying data is found in the database. The terminal unit is
25 permitted to control the target electric appliance only when the identifying data included in the first control signal is found

in the database.

A transmission step of the first control signal from the mobile telephone to the base unit comprises the steps of: transmitting a calling signal to the base unit; in response to an authentication request received from the base unit,
5 transmitting an authentication code to the base unit; and when the authentication code has been verified, transmitting the first control signal to the base unit.

At the base unit, further preferably, a remote control
10 permission step comprises the steps of: checking the identifying data included in the first control signal whether the identifying data is found in a database storing data each identifying the electric appliances; and transmitting the second control signal to the terminal unit to permit the terminal unit to control the
15 target electric appliance only when the identifying data included in the first control signal is found in the database.

As described above, the mobile telephone is used as a remote commander to transmit a first control signal for control of a target electric appliance to the
20 base unit. The transit switch of the base unit analyzes the first control signal to transmit a second control signal to a terminal unit corresponding to the target electric appliance located in the house. The terminal unit controls the target electric appliance depending on the control data included in the second
25 control signal. Therefore, easy control of the electric appliances variously located in house can be achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred features of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a block diagram showing a home automation system according to a first embodiment of the present invention;

Fig. 2 is a schematic diagram showing an example of the first
5 embodiment applied to a house;

Fig. 3 is a diagram showing a command format of a transmission signal transmitted from a PHS telephone to a base unit;

Fig. 4 is a schematic diagram showing a home automation
10 system according to a second embodiment of the present invention, which is applied to a house;

Fig. 5 is a block diagram showing an internal circuit of a base unit according to the second embodiment;

Fig. 6 is a diagram showing a command format of a
15 transmission signal transmitted from PDC telephone to PDC/PHS base unit;

Fig. 7 is a diagram showing a sequence of control signals

exchanged between PDC telephone and PDC/PHS base unit in the second embodiment; and

Fig. 8 is a block diagram showing an internal circuit of a base unit according to a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in Fig. 1, it is assumed that a home automation system according to the present invention is composed of a base unit 100, a terminal unit 200, and a PHS (Personal Handy-phone System) telephone 300. The base unit 100 serves as a transit switch from the PHS telephone 300 to the terminal unit 200. The terminal unit 200 is provided with IR control function for home electric appliances (not shown).

In the base unit 100, a processor (CPU) 101 controls the operations of the base unit 100 including a transit control. Under control of the processor 101, a control data analyzer 102 analyzes a control command received from the PHS telephone 300.

A reception system is composed of a receiver controller 104, a receiver 105, and a receiving antenna 106. A transmission signal transmitted by the PHS telephone 300 is received by the receiver 105 through the antenna 106 under control of the receiver controller 104. The receiver 105 demodulates it to produce

received data, which is analyzed by the control data analyzer 102.

A transmission system is composed of a transmitter controller 103, a transmitter 107, and a transmitting antenna 108. When receiving the result of analysis from the control data
5 analyzer 102, the processor 101 determines a terminal unit 200 to be called and outputs a control command to the transmitter 107 through the transmitter controller 103. The transmitter 107 generates a low-power radio signal modulated according to the control command and transmits it to the terminal unit 200.

10 The terminal unit 200 has a receiving antenna 201 connected to a receiver 202. When receiving the control command signal from the base unit 100 through the receiving antenna 201 under control of a receiver controller 203, the receiver 202 demodulates it to output received data to a control data analyzer 204.

15 The terminal unit 200 is provided with a control format memory 205 storing a control command format for the corresponding home electric appliance. The control data analyzer 204, referring to the control format memory 205, produces a control signal for that home electric appliance. According to the control
20 signal, an IR transceiver controller 206 drives an IR transmitter (LED) of an IR transceiver 207 to emit a modulated IR light to the home electric appliance. An IR receiver (photodiode) of the IR transceiver 207 receives an IR signal indicating an operation state of the home electric appliance.

25 Referring to Fig. 2, it is assumed that a house 400 has four rooms A, B, C, and D, the room A having TV 401 and VCR 402 installed

received data, which is analyzed by the control data analyzer 102.

A transmission system is composed of a transmitter controller 103, a transmitter 107, and a transmitting antenna 108. When receiving the result of analysis from the control data
5 analyzer 102, the processor 101 determines a terminal unit 200 to be called and outputs a control command to the transmitter 107 through the transmitter controller 103. The transmitter 107 generates a low-power radio signal modulated according to the control command and transmits it to the terminal unit 200.

10 The terminal unit 200 has a receiving antenna 201 connected to a receiver 202. When receiving the control command signal from the base unit 100 through the receiving antenna 201 under control of a receiver controller 203, the receiver 202 demodulates it to output received data to a control data analyzer 204.

15 The terminal unit 200 is provided with a control format memory 205 storing a control command format for the corresponding home electric appliance. The control data analyzer 204, referring to the control format memory 205, produces a control signal for that home electric appliance. According to the control
20 signal, an IR transceiver controller 206 drives an IR transmitter (LED) of an IR transceiver 207 to emit a modulated IR light to the home electric appliance. An IR receiver (photodiode) of the IR transceiver 207 receives an IR signal indicating an operation state of the home electric appliance.

25 Referring to Fig. 2, it is assumed that a house 400 has four rooms A, B, C, and D, the room A having TV 401 and VCR 402 installed

case of air conditioner, a command C-5 is a power-on/off command and a command C-6 is a temperature setting command. Finally, a symbol C-7, "#", indicates the end of control data.

As shown in Fig. 3, when the user inputs a control command
5 such that C-1 = "1", C-3 = "4", C-4 = "0", C-5 = "1" and C-6 =
"25" and transmits it to the base unit 100, the air conditioner
404 installed in the room D is controlled such that it is powered
on and the room temperature is set to 25 degrees Celsius.

Consider that the user who is located at the room A wants
10 to change the set temperature of the room D. When the receiver
105 of the base unit 100 receives the transmission signal from
the PHS telephone 300 located in the room A, the transmission
signal is demodulated and the received data is output to the
processor 101. The processor 101 instructs the control data
15 analyzer 102 to analyze the received data to produce the control
command having the temperature setting command C-6 = "25". The
processor 101 determines from the room number command C-3 that
a terminal to be called is the terminal unit 200A. Then, the
processor 101 controls the transmitter controller 103 so that a
20 control command signal is transmitted to the terminal unit 200A.

When the terminal unit 200A receives the control command
signal from the base unit 100, the control data analyzer 204
analyzes and converts the received control command to a control
signal according to the predetermined format for the target home
25 electric appliance (here, air conditioner 404) determined by the
appliance code C-4 by referring to the control format memory 205.

Based on the control signal, the IR transceiver controller 206 controls the IR transceiver 207 so that an IR control signal is transmitted to the air conditioner 404. In this manner, the air conditioner 404 installed in the room D operates so that the room temperature of the room D is kept at 25 degrees Celsius.

In the first embodiment as described above, PHS telephone 300 is used as a mobile telephone. A cellular telephone can be also used to control each home electric appliance. In general, the PHS telephone 300 also serves as a cordless telephone to directly communicate with the base unit, but a cellular telephone is designed to communicate with the base unit through a public telephone network. Therefore, to directly communicate with the base unit in the case of a commercially-available cellular telephone used, it should be designed according to Japanese digital cellular phone standard: PDC (Personal Digital Cellular).

As shown in Fig. 4, a second embodiment using PDC telephone 500 will be described using the same house arrangement as in Fig. 2. To allow both PHS and PDC telephones to be operable, it is necessary for a base unit 600 to be designed for both PHS and PDC specifications in this embodiment. The details of the PHS/PDC base unit 600 will be described hereafter.

Referring to Fig. 5, in the PHS/PDC base unit 600, a processor (CPU) 601 controls the operations of the base unit 600 including transit control. Under control of the processor 601, a control data analyzer 602 analyzes a control command received from one of the PHS telephone 300 and the PDC telephone 500.

A reception system consists of PHS and PDC systems. The PHS system is composed of a PHS transceiver controller 603, a PHS transceiver 604, and an antenna 605. The PDC system is composed of a PDC transceiver controller 608, a PDC transceiver 607, and an antenna 606. A transmission signal transmitted by the PHS telephone 300 is received by the PHS transceiver 604 through the antenna 605 under control of the PHS transceiver controller 603. The PHS transceiver 604 demodulates it to produce received data, which is analyzed by the control data analyzer 602. Similarly, a transmission signal transmitted by the PDC telephone 500 is received by the PDC transceiver 607 through the antenna 606 under control of the PDC transceiver controller 608. The PDC transceiver 607 demodulates it to produce received data, which is analyzed by the control data analyzer 602.

A transmission system of the PHS/PDC base unit 600 has the same configuration as the base unit 100 of Fig. 1 and the terminal unit 200 also has the same circuit configuration. Therefore, the similar circuit blocks are denoted by the same reference numerals and their descriptions are omitted.

The PHS/PDC base unit 600 can switch between PHS/PDC public mode and PHS private mode. In the case of PHS/PDC public mode, the base unit 600 can be connected to a public telephone line to exchange speech signals. In the case of PHS private mode, the base unit 600 can directly connect the terminal units 200, directly receive a transmission signal from PHS or PDC telephone and control a home electric appliance by sending a control command signal to

a corresponding terminal unit 200.

As described in the first embodiment, a control command is input by a user operating the ten-key pad of the PHS telephone 300 or the PDC telephone 500. The details of the control command transmitted by the PDC telephone 500 will be described hereafter.

Referring to Fig. 6, a command C-11 indicates the number of room where a target terminal unit is located. A symbol C-12, "*", serves as a separator between commands. A command C-13 indicates a code assigned to each home electric appliance. The commands following the command C-13 each have different formats for each home electric appliance. In the case of VCR 402, a command C-14 is a record/playback setting command, a command C-15 is a channel designation command, a command C-16 is a recording start time setting command, and a command C-17 is a recording stop time setting command. In the case of Fig. 6, the VCR 402 is set so that a program starting at 20:00 and ending at 21:54 is recorded.

An operation of the second embodiment will be described with reference to Fig. 7, taking as an example the case where the PDC telephone 500 is used to instruct the VCR 402 to record the program in the user's absence.

Referring to Fig. 7, the user uses the ten-key pad of the PDC telephone 500 to call the base unit 600 of the user's home (step S11). When the PDC reception system receives a calling signal from the PDC telephone 500, the base unit 600 transmits an acknowledgement signal and further transmits an authentication request signal to the PDC telephone 500 (step S12). At the request

of the base unit 600, the user inputs a predetermined authentication code and transmits it to the base unit 600 (step S13).

When receiving the authentication code from the PDC telephone 500, the base unit 600 transmits an acknowledgement signal and further transmits a control code request signal to the PDC telephone 500 (step S14). At the request of the base unit 600, the user uses the ten-key pad to input a desired control code as shown in Fig. 6 and transmits it to the base unit 600 (step S15).

When receiving the control code from the PDC telephone 500, the processor 601 of the base unit 600 verifies the terminal unit 200 to be called and the control code from the room number included in the control code. If they are verified, the base unit 600 transmits an acknowledgement signal to the PDC telephone 500 (step S16). When receiving the acknowledgement signal from the base unit 600, the user determines that the remote control has been successfully accomplished and switches off the off-hook key to terminate the communication with the base unit 600 (step S17). Therefore, the security is improved.

When receiving the control code as shown in Fig. 6 from the PDC telephone 500 located outside, the processor 601 determines from the room number command C-11 that a terminal to be called is the terminal unit 200C. Then, the processor 601 controls the transmitter controller 103 so that a control command signal is transmitted to the terminal unit 200C.

When the terminal unit 200C receives the control command signal from the base unit 600, the control data analyzer 204 analyzes and converts the received control command to a control signal according to the predetermined format for the target home electric appliance (here, VCR 402) determined by the appliance code C-13 by referring to the control format memory 205. Based on the control signal, the IR transceiver controller 206 controls the IR transceiver 207 so that an IR control signal is transmitted to the VCR 402. In this manner, the VCR 402 installed in the room A operates so that the program starting at 20:00 and ending at 21:54 is recorded.

The PHS telephone 300 has a transmission power of several tens mW and the PDC telephone 500 has a transmission power of several W. Since the transmission power of the PDC telephone 500 is larger than that of the PHS telephone 300, using the PDC telephone 500 as a remote commander has the advantage that it is possible to control a home electric appliance at a distance several times as great as in the case of the PHS telephone 300.

Referring to Fig. 8, a base unit 700 according to a third embodiment of the present invention is provided with an appliance ID analyzer 701 and a registered appliance database 702 in addition to the circuit blocks 601-608, 103, and 107 of the base unit 600.

When receiving a control command from the PDC telephone 500, the processor 601 instructs the appliance ID analyzer 701 to search the received control command for an identification number ID of a target home electric appliance. Thereafter, the registered

appliance database 702 is searched for the received appliance ID. If the target home electric appliance having the found appliance ID exists, then the remote control request is permitted. If the received appliance ID is not found in the registered appliance database 702, the remote control request is refused. Therefore,
5 the security is further improved.

The base unit 100, 600, or 700 may be provided with a telephone line connecting circuit to allow home automation from outside through a public telephone network.

10 Further, the present invention is not restricted to an indoor appliance such as air conditioner, refrigerator, TV or VCR. The present invention can also be applied to an outdoor apparatus such as opening equipment for use in an electrically operated gate or garage.

While the present invention has been described in its preferred embodiments, it is to be understood that the words which have been used are words of description rather than limitation and that changes may be made to the invention without departing from its scope as defined by the appended claims.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.

The text of the abstract filed herewith is repeated here as part of the specification.

A home automation system composed of a mobile telephone, a base unit, a plurality of terminal units, and a plurality of electric appliances is disclosed. The mobile telephone is capable of communicating with the base unit to transmit the base unit a first control signal conveying appliance identifying data and control data. The base unit includes a transit switch for receiving the first control signal and transmitting a second control signal to a terminal unit determined according to the identifying data included in the first control signal. The terminal unit comprises an appliance controller for controlling a target electric appliance identified by the identifying data included in the second control signal depending on the control data.

Claims:

1. A base unit for use in an appliance control system, comprising:
means for receiving a first control signal from a telephone; and
5 means for transmitting a second control signal to one of a plurality of terminal units in dependence upon the first control signal to cause said terminal unit to control an appliance associated with the terminal unit in dependence upon the second control signal.
- 10 2. A base unit according to Claim 1, wherein the means for transmitting the second control signal is adapted to transmit the second control signal at a radio frequency.
3. An appliance control system comprising the base unit according to Claim 1 or
15 Claim 2 and a plurality of said terminal units.
4. A control system according to Claim 3, wherein each terminal unit is adapted to transmit an IR signal towards its associated appliance so as to control this appliance.
- 20 5. A method of controlling a plurality of appliances comprising:
transmitting a first control signal from a telephone to a base unit;
transmitting a second control signal from the base unit to one of a plurality of terminal units in dependence upon the first control signal, thereby causing the
25 terminal unit to control an appliance associated with the terminal unit in dependence upon the second control signal.
6. A method according to Claim 5, wherein the second control signal is transmitted at a radio frequency.
- 30 7. A method according to Claim 5 or Claim 6, wherein the terminal unit controls its associated appliance by transmitting an IR signal towards this appliance.

8. A home automation system comprising a base unit located in a house, a plurality of terminal units which belong to the base unit and are located in an area of the house, and a plurality of electric appliances located in the area of the house, wherein each of the electric appliances belongs to one of the terminal units and is capable of being controlled depending on control data, further comprising:

a mobile telephone capable of communicating with the base unit, to transmit a first control signal to the base unit, the first control signal conveying identifying data for identifying a target electric appliance and control data for the target electric appliance;

the base unit comprising a transit switch for receiving the first control signal from the mobile telephone and transmitting a second control signal to a terminal unit determined according to the identifying data included in the first control signal, the second control signal conveying the identifying data and the control data; and

the terminal unit comprising an appliance controller for controlling the target electric appliance identified by the identifying data included in the second control signal depending on the control data.

9. The home automation system according to claim 8,
wherein:

the mobile telephone transmits the first control
signal of a first radio frequency;

5 the transit switch transmits the second control
signal of a second radio frequency different from the first radio
frequency; and

the appliance controller transmits an infrared
control signal to the target electric appliance.

10 10. The home automation system according to claim 8 or
9, wherein the mobile telephone is one of a PHS (Personal
Handy-phone System) telephone and a digital cellular telephone,
wherein the identifying data and the control data of the first
control signal are input through a ten-key pad provided in the
15 mobile telephone.

11. The home automation system according to claim 10,
wherein

the mobile telephone is one of a PHS telephone and
a PDC (Personal Digital Cellular) telephone, and

20 the base unit further comprises a transceiver
designed for both the PHS telephone and the PDC telephone.

12. The home automation system according to claim 8 or
9, wherein the base unit further comprises:

a database retrievably storing data each identifying the electric appliances; and

an identification checker for checking the identifying data included in the first control signal whether the
5 identifying data is found in the database.

wherein the terminal unit is permitted to control the target electric appliance only when the identifying data included in the first control signal is found in the database.

13. The home automation system according to any of claims
10 8-12, wherein the appliance controller of the terminal unit comprises:

a control format memory storing a control command format of each of the electric appliances to convert the control data included in the second control signal into the control command
15 format of the target electric appliance.

14. A method for controlling a plurality of electric appliances located in an area of a house, wherein a base unit is located in the house, a plurality of terminal units belong to the base unit and are located in an area of the house, and each of
20 the electric appliances belongs to one of the terminal units and is capable of being controlled depending on control data, the control method comprising the steps of:

at a mobile telephone capable of communicating with the base unit,

a) transmitting a first control signal to the base unit, the first control signal conveying identifying data for identifying a target electric appliance and control data for the target electric appliance;

5 at the base unit,

b) receiving the first control signal from the mobile telephone;

c) transmitting a second control signal to a terminal unit determined according to the identifying data included in the first control signal. the second control signal conveying the
10 identifying data and the control data; and

at the terminal unit,

d) controlling the target electric appliance identified by the identifying data included in the second control
15 signal depending on the control data.

15. The method according to claim 14, wherein the step a) comprises the steps of:

a.1) transmitting a calling signal to the base unit;

a.2) in response to an authentication request
20 received from the base unit, transmitting an authentication code to the base unit; and

a.3) when the authentication code has been verified, transmitting the first control signal to the base unit.

16. The method according to claim 15, wherein the step c)

a) transmitting a first control signal to the base unit, the first control signal conveying identifying data for identifying a target electric appliance and control data for the target electric appliance;

5 at the base unit,

b) receiving the first control signal from the mobile telephone;

c) transmitting a second control signal to a terminal unit determined according to the identifying data included in the first control signal, the second control signal conveying the identifying data and the control data; and

10

at the terminal unit,

d) controlling the target electric appliance identified by the identifying data included in the second control signal depending on the control data.

15

15. The method according to claim 14, wherein the step a) comprises the steps of:

a.1) transmitting a calling signal to the base unit;

a.2) in response to an authentication request received from the base unit, transmitting an authentication code to the base unit; and

20

a.3) when the authentication code has been verified, transmitting the first control signal to the base unit.

16. The method according to claim 15, wherein the step c)